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Wikis supporting authentic, collaborative activities: lessons from distance education

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Abstract

The Open University delivers distance learning to its students. Traditionally, its students work independently of each other. Looking to enhance their students learning, two post-graduate courses have introduced authentic, collaborative activities. This is easier to achieve now because of the availability of wikis: a lightweight, web-based collaborative authoring environment. This paper examines the effect of the wikis' functionality on the students' use of the tool, and the consequences for the students' engagement with the activities and learning opportunities. This is a relatively large scale study involving 56 wikis produced by over 250 students. The data was drawn from the two courses using a variety of methods. A qualitative inductive analysis was used to look for emergent themes. These were validated by cross referencing, to match recorded comments with wiki content. We found that the limited functionality of wikis influenced how students engaged with the collaborative activities. While all groups were able to collaboratively author the documents required for assessment, they were not always produced in the way intended by the course teams. This meant the expected benefits of collaborative learning were not always realised. This paper will be of interest to academics aspiring to employ wikis on their courses and to practitioners who wish to realise the potential of wikis in facilitating information sharing and fostering collaboration within teams.

Introduction

This paper reports our investigations into the pedagogical effectiveness of wiki-enabled authentic, collaborative activities. The Open University (OU) has around 200,000 adult distance students who mainly study part-time. The university has a pedagogy based on supporting the independent learner. Collaboration among students is recognised as beneficial to their learning (Laurillard, 2002) as is the supporting role of technology (Laurillard, 2008). The OU's use of technology has evolved in step with technological changes, especially the Internet (Thomas *et al*, 1998). The OU provides dedicated online tools such as FirstClass for asynchronous text-based discussions and Lyceum, an audio-conferencing tool with shared workspace, for synchronous collaborative activities for

student mutual support and formal use in learning activities. The OU has embarked on a €7.5m programme to introduce an integrated virtual learning environment (VLE). The OU has adopted an open source VLE, Moodle (Moodle, 2008) which offers course teams a wider range of collaborative tools.

Moodle's toolset includes a wiki. A wiki is a collaborative authoring environment, "*designed to facilitate exchange of information within and between teams*" (Goodnoe, 2006). Moodle's wiki was adapted by the OU to its specific requirements and adopted in several courses to support collaborative activities. This gave us the opportunity to gather and evaluate data to answer the research questions on the usability and functionality of wikis to support collaboration and the effectiveness of wikis in the collaborative tasks.

We initially looked at the introduction of small group collaboration into the post-graduate Computing course, Software Requirements for Business Systems, which emulates Requirements Engineering (RE) practice. In contemporary software development projects the elicitation of requirements is generally carried out by a team of requirements analysts who often work remotely from one another. Wikis are increasingly being used for collaboratively developing requirements specification documents (Farrell, 2006).

We extended our research to include a post-graduate course in the OU's Business School, Current Issues in Public Management and Social Enterprise, which introduced a wiki to support the authentic learning task of collaboratively writing a report on a contemporary management issue. This allowed us to compare the wiki's use in different domains to develop our research questions. We expected fewer Business students' to be familiar with wiki technology, and so might highlight additional aspects of wiki functionality not exposed by the Computing students. However, because many other Business School courses already incorporate group work using asynchronous discussion forums, we expected the Business students to be more familiar with collaborative tasks than the Computing students. Hence we would have another perspective on the effectiveness of wiki as a tool in supporting collaborative activities.

Related work

Wikis are a readable and writeable websites in which all the visitors to the site can create new pages or modify existing ones (Choate, 2008). In providing an environment in which students can share knowledge, educators are realising the potential of wikis by making the change from traditional linear learning paradigms to socio-constructivism (Bruns and Humphreys, 2005).

Several course teams at the OU want to embrace the socio-constructivist pedagogical model, whose three main characteristics are: complex and realistic problems (authentic tasks); group collaboration, interaction and cooperation; and learners are responsible for setting goals, while teachers provide guidance (from Merriënboer and Pass, 2003, quoted in Schneider and Synteta, 2004). This model of learning matches the evolution of the network economy and the working practices required by many students, including ours, in their careers (Bruns and Humphreys, 2005).

There have been several experiments using wikis in education. For example, Chao (2007) reports success in the use of wiki for student project collaboration in an undergraduate project-based software engineering course. The end of course survey elicited 28 responses from the 38 students, of whom 25 thought the wiki was good for project collaboration overall and used it regularly, 2 were neutral, only 1 thought it bad.

The experiments have highlighted some shortcomings in wikis; for, in ensuring that "*a wiki is the simplest online database that could possibly work*" (Leuf and Cunningham, 2001), many potentially useful features were omitted. These include a WYSIWYG editor,

commonly found in other authoring tools such as Microsoft Word, and with which most computer users are familiar. The emphasis in a wiki, according to the original design principles, is on content, not presentation. Therefore, simple mark-up rules were devised to help make people focus on expressing their ideas, not making them “*pretty*” (WhyDoesntWikiDoHtml, 2008).

This approach means the source page is readable as well as the formatted page. For this reason also, HTML is little used in wikis even though the pages are presented in HTML in a browser. The many cryptic tags of HTML are not very legible, making it harder to edit than the plain text style of wikis with their fewer and simpler conventions (EditingWikiPages, 2008).

Sometimes, additional software is necessary; one recurring example in the literature is support for images. For example, Aguiar *et al* (2003) describe the development of plug-in extension to access Eclipse Integrated Development Environment (IDE) from within a wiki to enable their students to draw Unified Modelling Language (UML) diagrams. This, though, is a specific example for wiki users who are already familiar with, or willing to learn to use, the additional tool. It is relatively easy to enable wikis to support images through links. The degree of support for images is used to distinguish wikis (WikiMatrix, 2008; Schwartz *et al*, 2004). Generally though, the minimalist text based philosophy of wikis precludes images.

The complications arising from additional software are not confined to the need to support images. For example, when a wiki is used as a Content Management System (CMS) it is viewed no longer as a working document, but a universally accessible repository for a set of working documents. In one case, students studying symbolic logic shared their work through a wiki as a CMS. They downloaded their peers' writings and edited the work in Microsoft Word using the Track Changes facility, before uploading it to the wiki for others to review (Byron, 2005). This left open other issues, such as communicating the current status of the working documents and of enforcing a time after which no more changes to them will be accepted (Decker *et al*, 2007).

Notwithstanding these limitations, several OU course teams saw that wikis could be used to support collaborative activities, especially those that emulate work place practice. These activities would provide students with the complex and realistic problems of the socio-constructivist model.

The following sections of this paper look at the use of wikis to enable collaborative learning with particular reference to issues arising from the wiki as a tool, especially the role of the editing interface and the formatting of wiki documents, and the use of wiki as a CMS, especially for diagrams.

Methodology

Data drawn from the two courses include the reporting of wiki activities in the students' assessment questions; comments by students to their peers and tutors made in the general course discussion forums; end of course questionnaires; students and tutors' comments during retrospective semi-structured interviews; and the content of the wikis themselves. This has been relatively large scale study looking at 56 wikis produced by over 250 students. Data gathering was completed in December 2007.

Responses are identified with the codes: B... for Business students, T... for Business tutors, and C... for Computing students.

We examined the data looking for comments on wiki usability and functionality, and on the consequent effectiveness of wiki to support the collaborative activities. We were not testing any hypotheses in our analysis, but were looking for themes to emerge from the data. Benefiting from the large quantity of data and rich variety of sources, we were able to validate

the emergent themes by cross-referencing comments with corroborating entries in the wikis and forums. This paper presents our findings from that inductive qualitative analysis.

The limitations of wikis

Wikis were originally designed to have limited functionality – to be lightweight – and retain this philosophy (Choate, 2008). Seven distinct classes of limitation emerged from our analysis of students' and tutors' experiences with the wikis. They were: as an editor, as a tool for learning, as an authoring tool, as a report writing tool, as a link to other tools, as a means of attributing contributions and as a means of co-ordinating contributions. We discuss each of these limitations in turn.

As an editor

Our students' experience of wikis varied from first-time users to those who use wikis in their work outside the OU, and are familiar with different implementations. This led to a variety of responses to the wikis used in our courses.

Some, such as student C5, reported no features were missing from our offering; C34 in contrast stated that "[being] a wikipedia editor, this wiki interface offends me!" Arguably a more balanced view was provided by a peer of C34, and also an experienced wiki user, who stated that the supplied wiki provided "*basic wiki functions [but] it was not nearly as sophisticated as others I have used*". As a consequence, C16 says he spent large amounts of time solely on formatting wiki content. Ultimately, he, "...ended up editing using the html source...". This was the only recorded use of direct HTML editing in place of the default mark up language.

C8 was one of the few to suggest a WYSIWYG editor be provided. He added that while the wiki was not very good it was good enough for its intended use in this course. To which he then added, almost as an aside, that not having extra features meant there was less to learn "*which was good*".

As a tool for learning

Most learning, however, was not about the wiki, nor about the course materials, but about the practicalities of group work: "*The wiki didn't really help understand the whole [requirements engineering] process, just the difficulties in collaborating and making everyone's voice heard*." (C21).

Other students (C6, C16 and others) stated that they learnt as much about collaboration as requirements engineering. Some students did learn about the course concepts, rarely through discussion however. Instead it was through simply seeing other people's writing, which included "*some very strange answers from other people but interesting*" (C4). Indeed, one student reported that they not only "*learnt about different styles of expressing requirements*" but "*learnt about the different sorts of ...requirement engineers*" (C7).

As an authoring tool

This ability to see other students work suggests that the wiki was succeeding in its intended role as common tool for the students' contributions, or as reported by C17: "*The wiki was efficient in that it was a central place for us all to put our ideas*."

The wiki in the business course was the subject of similar praise. T1 commented favourably that "*at least with the wiki you knew ... what you were looking at was the latest position*."

This is expanded upon by student B14: "*it provided a central shared version of the report which any of us could work on at any time*." However, he goes on to say about his group:

"I'm not sure what advantage the WIKI provided compared to what would have been secured through each of us posting a revised Word version of the report reflecting the additions/revisions we made." This view was contradicted by only one student in the business course, B12, who thought a wiki to be *"excellent better even than Track Changes in Word."* For the majority of groups, as tutor T2 declared, the wiki *"turned into a filing cabinet really."* The students thought it highly effective in this role, with B5 commenting favourably that *"document control [was] maintained/managed"*, but for most of them the wiki had lost its purpose as an authoring tool.

As a report writing tool

Many students reported they were new to wiki technology and other aspects of the course. For example, *"The Wiki as a concept is very new to me; the overall approach to collaborative contribution (other than through a formal document review process) also was."* (C3). In such circumstances, and owing to the pressure of having to pass examinations, it was not surprising to find students falling back on old, proven ways, particularly when they hit problems with the new technology.

A recurring problem was the students' expectation that they had to write a 'traditional' report. In the Computing course a variety of answers were developed to this problem, including *"One fellow student ended up printing out the requirements [onto cards] ... to enable categorisation and review. I continued with scrolling up and down the requirements which, in hind sight, was probably not as efficient."* (C3). Most wikis were formatted into smaller screen sized pages. However, while students on the business course also reported problems with long pages their solution was different.

As tutor T2 said *"on this program [students] are used to sitting at their computers creating Word documents, sending them to people attached to a message saying have a look at this what do you think having somebody tinker with the document or send back feedback whatever."* The majority of her groups did not use the wiki to write their report, but only to present the final version, previously developed in Word, and only then because it was the course requirement for assessment.

This last minute conversion of the report was not without problems, especially as the students had not adjusted to the different features of the wiki. Hence this complaint from B14, that in the wiki you *"couldn't even number pages!!!"* This suggests a clear mismatch between expectations and the tool provided.

As a link to other tools

Another common thread in the students' experience of sharing their work through the wiki was the problem of language. *"It became apparent that is important to be consistent in the use of terminology and phraseology of requirements ... This was demonstrated in the discussions about whether 'parameterised dates' should be used instead of 'specified date range'"* reported by C6. This problem had been foreseen in the business course, and a course glossary had been created in the VLE, and students could add new terms to the glossary.

All words defined in the glossary were automatically highlighted with a grey background when used in the wiki, which several students did not like because it overrode the formatting they wished to apply.

Students were encouraged, though not required nor assessed, to extend the glossary. This facility of the VLE was little used during the course but as a member of the Course Team advised the tutors, *"one of the students has spotted that when a glossary change is made they can also at the same time add a comment which makes clear who added it."* This

feature highlights one of the issues of the limited wiki functionality that particularly exercised the students: demonstrating who made the contributions; for it was necessary to prove contributions to gain course marks.

As a means of attributing contributions

T2, a tutor, complained that working out who had contributed what was, “*a real difficulty.*” The students “*couldn’t make the comments look visibly different it was difficult to see who made what comment...even simple things like I’m red you’re blue... proved difficult.*” If it was not easy to write in the wiki to distinguish content from comments and to easily identify contributors, it was sufficiently easy to produce “*difficulty in maintaining consistency of style and approach when different members are writing different sections.*” (B22).

The problems of attribution were sometimes compounded by the students themselves, as C6 complained of his group: the group discussion took place in the content page rather than associated discussion page.

Again, previous experience played a role here for some students, such as B11: “*Discussion threads [in a forum] were the most useful way of exploring individual issues and getting agreement on how to handle them in the collaborative reports. I didn’t find the wiki particularly useful for this purpose.*” In his group both discussion and content creation were removed from the wiki entirely.

As a means of co-ordinating contributions

The most commonly cited reason for taking discussion outside the wiki was to co ordinate contributions. “*The wiki relies on everybody accessing it whereas email is something that gets read as part of normal life outside the Open University.*” (C17). Students were familiar with looking at their email daily, but not at checking the wiki daily too. Not looking at the wiki daily leads to a problem C17 later described as “*[the] temptation to wait for other people to do the work – then sheer frustration when everybody else does the same thing.*” The simple wiki is a pull, not push, technology, which means that contributions are unknown unless one deliberately looks for them.

Student C3 expressed the following sentiment: “*With several different contributors, it also becomes apparent about the level of organisation required. Co-ordinating different people’s comments and inputs require a lot of effort – which was one failure of the Wiki group I was a member of; mainly we did not agree our approach at first. This really highlights the need to have an overall co-ordinator / manager of the Wiki.*” The sentiment summarised in this statement was echoed by others.

Summary of limitations

Wikis were originally designed to be lightweight. The consequent limitations, as reported by tutors and students, show they have adversely affected use of the wiki. Many students, especially Business students, were discouraged by the editing, authoring and report writing functions. This led to the use of other tools, mainly Word, for the writing task, with the wiki being used as a CMS. The limitations of the wiki in this role, led to the use of emails and forums to highlight updates. This meant the intended opportunities for discussion and sharing ideas within the wiki immediately alongside the relevant content were not fully realised.

There was one other reported limitation that became apparent through the differing design choices made by the course teams for the collaborative activities and the effect of the choice on their students’ behaviour. This is the subject of the next section.

Wikis are aimed at text based activities

The original wiki philosophy emphasised speed of use. To help achieve this, wiki functionality was limited. Though wikis have continued to emphasise their speed and ease of use, users have pushed at such limits of wiki functionality. One such example has been highlighted in our research: the constrained ability of a wiki to support diagrams and images.

Text-based activity in a diagram rich course

The Computing course makes extensive use of diagrams, as one student noted when asked if the course met her expectations: *"...if anything they are exceeding them. I didn't realise that the course materials would be as far reaching to include DFDs, UML, use cases, and other diagram work."* (C1).

In contrast, the course's socio-constructivist inspired collaborative activities were solely text-based. The students were to produce textual requirements, sufficient to show that they could capture and review requirements, but were not required to prepare a formal document. Therefore, neither the absence of a feature rich authoring tool to match Microsoft Word, nor the absence of native support for diagrams, were issues affecting the choice of tool to support the activities. This meant a wiki could be used, and the students recognised the attributes of this: *"the informal and easy-to-access style of the wiki made us a little careless in our writing I suppose. The result was very raw text, partly chat-type. Further input would be necessary in order to turn it into a real requirements document."* (C27).

Business students want to work the way they know

The business course was driven by the same socio-constructivist inspiration in designing collaborative activities. In addition, the course team wanted students to bring their own experiences to the course, and share them through the collaborative activities. (The students were drawn from a wide range of commercial, governmental and voluntary organisations). Crucially, this meant that the definition of a 'report' was not made explicit; it was to be what the students thought it should be.

Many students wanted to use diagrams in their reports. For example, B8 used a diagram to illustrate the case study he proposed should form the basis for his group's research. He sent out the document containing the diagram, eliciting this response from one of his peers on the forum, *"And a great diagram (wish I knew how to do diagrams of that calibre on the pc!)"*. However, the wiki itself did not support images, as some students learnt the hard way: *"...have just posted my part in (with diagrams) – these have not transferred in to report. This is a bit disappointing as I spent some time drawing them!"* (B9).

But which tools are familiar to whom?

This led to some ingenuity as students sought to host images (diagrams and illustrated figures) outside the wiki. One student set up a Facebook group to host diagrams; but this caused some problems as only one other group member was familiar with Facebook. The others had something new to learn: *"I've got the invitation and I'm going through the technical barriers (what exactly do I have to do). Will get there eventually"*, as shown by this request for help from B20.

Fortunately for the students, their tutor was able to use Facebook. So it was valid for them to consider *"it may well be the case that importing the document onto the wiki from word means we don't have some of the diagrams in which case we'll have to reference where to find them on the Facebook page."* (B22). The tutor was not solely committed to Facebook, and informed another group to: *"Let me know, too, where you are going to locate the diagrams (if you are planning to include any) for reading with the WIKI version."*

The tutor concerned favoured the use of diagrams, and when asked about how the wiki could be changed to support the activities replied that it should *“have the capacity to add diagrams.”* A sentiment repeated by many students in reply to the same question, for example, *“Being able to slot into the wiki diagrams in line with the flow of text.”* (B4). Such views coloured the tutors’ and students’ perceptions of the wiki and of the collaborative activity: the tool could not support the report they wanted to produce.

It’s not all the wiki’s fault

It is worth noting that problems with integrating diagrams into the report were not confined to sharing them through the wiki. B17 endeavoured to post them to the forum, but fell foul of the size limit for attachments. B14, from a group using a word document as their master copy of the report instead of the wiki informed her group that, *“[The] Quinn diagram still needs putting in as I couldn’t get it into my word document for some reason...”* The group made increasingly urgent forum postings as the submission deadline neared and the diagrams themselves needed reworking: revising diagrams and justifying the revisions were more difficult tasks than the group had realised.

Wikis are supposed to overcome this issue of complicated features issue through deliberate simplicity, offering only a limited tool set, an avoidance of additional software and an intuitive interface. However, this benefit is achieved at price of the range of activities a wiki typically supports.

Summary of wiki use

This section has highlighted the need to set student expectations. The Computing students were made more aware of the wiki philosophy and so were less frustrated than their Business peers. The Business students were determined to produce a report based on their experience of conventional paper-based documents and so became very frustrated with the wiki when it could not meet these expectations. Even when there are benefits, such as with the integrated glossary, the students did not want to see highlighted words in their report, because it did not match their expectations. This led to further complications for the Business students as they sought to address these frustrations. This meant there was less time for the students to engage in reflecting on the material than the course team intended.

Conclusion and next step

The collaborative activities in the courses in this study were derived from a desire to encourage students to learn by sharing their experiences and working in groups to produce a document that was the synthesis of their ideas and learning while engaged in an authentic task from RE, or management, practice. The relatively limited scope of the activities suggested that they could be supported by a wiki.

We have used data from two courses in different disciplines for our research into the usability and functionality of wikis to support collaboration; and the effectiveness of wikis in the collaborative tasks.

The functionality of the wiki was adequate for limited scope of the artefacts to be produced in the collaborative activities. It had sufficient editing, authoring and report writing facilities, however, the students’ ambitions exceeded these facilities to the detriment of their willingness to participate in the activity. This suggests the students need more guidance on the nature of the artefacts they are to produce, perhaps supplementing the existing course guidelines with more explicit templates.

The wiki’s limitations influenced the way the groups worked together. When discussion did take place, it was often using other tools such as email to overcome the wikis’ weaknesses

in reporting changes in content, and the difficulty of tracking contributions within the wiki. The students found it easier to reach agreement outside the wiki, usually through a shared Word document, and then to copy in an agreed statement.

Wikis' integration with other tools is not without problem, even though technological barriers may be minimal and the pedagogical benefits desirable. The use of wiki as a CMS also requires careful consideration. The wiki can be successful in this use, but students need to be aware of good working practices.

We had identified several ways in which we hoped the collaborative activities would lead to collaborative learning to the benefit of our students such as through 'consensus building' or 'articulation of ideas'. The analysis suggests the greatest benefit arose from the wikis' ability to let students see their peers' contributions and to reflect on the different perspectives in these contributions.

The wiki does have sufficient functionality to enable collaboration; however, to be fully effective in realising all of the potential benefits of collaborative activities, our research suggests that a wiki alone is insufficient for the task.

Our next step is to follow up this research by revisiting the 56 wikis and supporting data sources to look for the influence of the collaborative activities' design on wiki use by students. This will look at the inter-relationship between the wiki and the activity for factors on one that can help or hinder the effectiveness of the other.

References

- Aguiar, A., David, G. and Padilha, M.** (2003) *XSDoc: an Extensible Wiki-based Infrastructure for Framework Documentation*. Proceedings of JISBD'03, (Alicante, Spain, November 2003), IEEE, 11–24.
- Bruns, A. and Humphreys, S.** (2005) *Wikis in teaching and assessment: the M/Cyclopedia project*. Proceedings of Wikisym'05, (San Diego, CA, USA, October 2005), ACM Press, 25–32.
- Byron, M.** (2005) *Teaching with Tiki*. Teaching Philosophy, 28, 2, 108–113.
- Chao, J.**, (2007), *Student Project Collaboration using Wikis*. Proceedings of CSEET'07, (Dublin, Ireland, July 2007), IEEE, 255–261.
- Choate, M.** (2008) *Professional Wikis*, Wiley Publishing, Indianapolis, IN.
- Decker, B., Ras, E., Rech, J., Jaubert, P. and Rieth, M.** (2007) *Wiki-Based Stakeholder Participation in Requirements Engineering*, IEEE Software, 24, 28–35.
- EditingWikiPages*. Retrieved February 29, 2008, from en.wikipedia.org/wiki/Wiki#EditingWikiPages
- Farrell, J.** (2006) **Wikis, Blogs and other Community Tools in the Enterprise**. Retrieved February 22, 2007, from: www-128.ibm.com/developerworks/library/wa-wikiapps.html
- Goodnoe, E.** (2005) *How to Use Wikis for Business*. Retrieved February 21, 2007, from www.informationweek.com/story/showArticle.jhtml?articleID=167600331
- Laurillard, D.** (2002) *Rethinking University Teaching*, Routledge, London, UK.
- Laurillard, D.** (2008) *Digital Technologies and Their Role in Achieving Our Ambitions for Education*. An inaugural profesorial lecture by Diana Laurillard. ISBN 978-0-85473-797-0 Institute of Education, London, UK.
- Leuf, B., and Cunningham, W.** (2001) *The wiki way: Quick collaboration on the web*, Addison Wesley, Boston, MA, USA.
- Moodle**. Retrieved February 29, 2008, from www.moodle.org
- Schneider, D. K. and Synteta, P.** (2004) *Conception and implementation of rich pedagogical scenarios through collaborative portal sites*. Retrieved February 26, 2007 from teca.unige.ch/proj/seed/catalog/docs/sevilla03-schneider.pdf.
- Schwartz, L., Clark, S., Cossarin, M., and Rudolph, J.** (2004) *Educational Wikis: features and selection criteria*. The International Review of Research in Open and Distance Learning, 5, 1. Retrieved February 22, 2007, from www.irrodl.org/index.php/irrodl/article/view/163/244
- Thomas, P., Carswell, L., Price, B and Petre, M.** (1998) *A holistic approach to supporting distance learning using the Internet: transformation, not translation*. British Journal of Educational Technology, 29, 2 149–161.
- WikiMatrix**. Retrieved February 29, 2008, from www.wikimatrix.org
- WhyDoesntWikiDoHtml**. Retrieved February 29, 2008, from c2.com/cgi/wiki?WhyDoesntWikiDoHtml